

## ABSTRACT

A method for operating a cyclone combustor having first and second burners in communication with a barrel includes: feeding a stream of a primary fuel and a primary oxidant having a first oxygen concentration into the first burner; feeding a stream of a secondary fuel and a secondary oxidant having a second oxygen concentration greater than or equal to the first oxygen concentration into the second burner; combusting at least a portion of the primary fuel with at least a portion of the primary oxidant in the barrel of the cyclone combustor, thereby forming a plurality of primary products of combustion in the barrel; and combusting at least a portion of the secondary fuel with at least a portion of the secondary oxidant, thereby forming a plurality of secondary products of combustion and a secondary flame, the secondary flame generating a supplemental radiant heat in the barrel.